

Mark schemes

Q1.

- (a) limestone 1
- sodium carbonate 1
- (b) (advantage) stronger 1
- (reason) less easily damaged 1
- (c) (advantage) lower density 1
- (reason) lighter (to install) 1
- (d)
- $$\begin{array}{cc}
 \text{H} & \text{Cl} \\
 | & | \\
 \text{C} & = & \text{C} \\
 | & & | \\
 \text{H} & & \text{H}
 \end{array}$$
- 1
- (e) (add damp) litmus paper 1
- (litmus paper) is bleached
or
 (litmus paper) turns white
ignore (litmus paper) turns red 1
- (f) (polymers)
 last a long time
ignore references to cost
allow break down slowly 1
- (wood)
 renewable
allow trees can be replanted
allow aesthetic reasons 1
- (g) (percentage of aluminium =)
 $\frac{5.94}{6.00} \times 100$ 1

= 99 (%)

1

- (h) (alloy is) harder (than pure aluminium)
allow (alloy is) stronger (than pure aluminium)
ignore references to cost

1

[14]

Q2.

- (a) fuel

1

- (b) propene

1

- (c) (percentage yield =)

$$\frac{380}{400} \times 100$$

1

= 95 (%)

1

- (d) some ethanol changes back into ethene and steam

1

some ethanol escapes from the apparatus

1

- (e) $\text{C}_2\text{H}_5\text{OH} + 3 \text{O}_2 \rightarrow$
 $3 \text{H}_2\text{O} + 2 \text{CO}_2$

allow multiples

1

- (f) (advantages)

(fermentation) low energy usage

1

(fermentation) uses renewable raw materials

1

(disadvantages)

(fermentation) produces impure ethanol

1

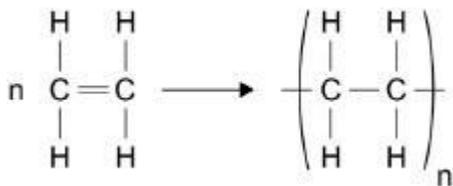
(fermentation) slow rate of reaction

1

[11]

Q3.

(a)

*if equation incorrect**allow 1 mark for 5 single bonds***or***allow 1 mark for n*

2

(b) (poly(ethene)) melts

*allow converse statements about
thermosetting polymers**allow thermosoftening polymers melt*

1

(so) can be reshaped (into new products)

1

(c) use different (reaction) conditions

*allow use different temperatures /
pressures*

1

(d) (in HDPE) polymer chains / molecules are closer together

*allow converse statements about LDPE
allow (HDPE has) unbranched polymer
chains / molecules*

1

(so) more atoms per unit volume

*allow (so) more molecules per unit
volume*

1

(e) circle around HO– **or** –OH on monomer **A**

1

(f) H₂O
and
HCl*must be in this order*

1

[9]**Q4.**

(a) disposal at the end of useful life

1

(b) heating in a furnace

| | | |
|-----|--|-------------|
| | | 1 |
| | shaping wet clay | 1 |
| (c) | polymers | 1 |
| | propene | |
| | <i>allow (a) monomer</i> | 1 |
| (d) | cracking | 1 |
| | fractional distillation | 1 |
| (e) | covalent | 1 |
| (f) | thermosetting | 1 |
| (g) | polymer A has crosslinks (between polymer molecules) or polymer B has no crosslinks (between polymer molecules) | 1 |
| | | [10] |

Q5.

| | | |
|-----|---|---|
| (a) | HCOOH | |
| | <i>allow HCO₂H</i> | 1 |
| | propanoic acid | 1 |
| (b) | incomplete / partial ionisation | |
| | <i>allow incomplete / partial dissociation</i> | 1 |
| | (because) reaction is reversible | |
| | <i>allow (because) reaction is in equilibrium</i> | 1 |
| (c) | mass (of flask and contents) decreases | 1 |
| | (because) carbon dioxide is produced | 1 |
| | (and) carbon dioxide escapes (from the flask) | |
| | <i>allow 1 mark for the gas produced escapes (from the flask)</i> | |

- (d) (0.01 mol/dm³) methanoic acid has a lower pH
allow converse argument for ethanoic acid
allow (0.01 mol/dm³) methanoic acid is a stronger acid

1

1

(so 0.01 mol/dm³) methanoic acid has a higher concentration of hydrogen ions

1

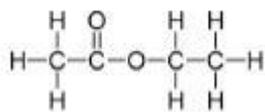
(therefore) more collisions per unit time

1

- (e) ethyl ethanoate

1

- (f)



1

[12]

Q6.

- (a) **test:** (use a) glowing splint
*do **not** accept burning splint*

1

result: relights

dependent on correct test in MP1
ignore with a pop

1

- (b) starch

1

cellulose

allow glycogen

1

- (c) 2

1

- (d) water

allow H₂O

1

- (e) ammonia

1

nitrogen

if no other mark awarded, allow 1 mark for NO / NO₂ / N₂O / NO_x or equivalent named compounds

1

- (f) two polymer chains

allow two polymer strands

1

four (different) monomers / nucleotides

allow four (different) bases

allow cytosine, guanine, adenine and thymine

allow C G A T

1

(double) helix

allow spiral

if no other mark awarded, allow 1 mark for DNA

1

[11]

Q7.

- (a) C=C bond in correct position

1

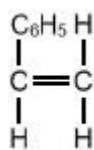
3x C-H **and** 1x C-C bond in correct positions

*do **not** accept any additional bonds or atoms*

ignore brackets and n before and after displayed structural formula

1

an answer of



scores 2 marks

- (b) carboxylic acid (group)

allow carboxyl (group)

1

- (c) water

allow H₂O

1

- (d) (polyester is) thermosoftening

allow (polyester is) thermoplastic

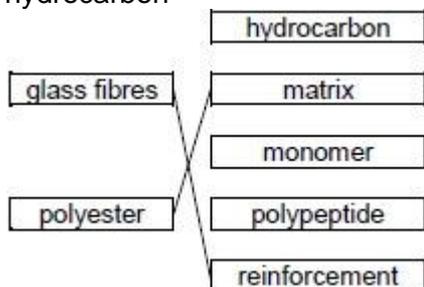
ignore thermoforming

1

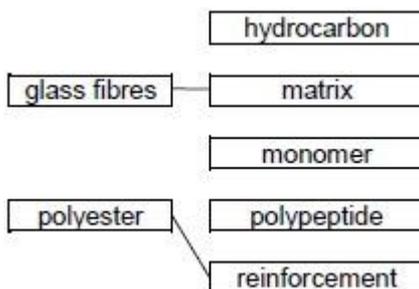
(polyester has) no cross-links
 allow intermolecular forces are weak
 do **not** accept references to breaking covalent bonds or breaking chains

1

(e) hydrocarbon



allow for 1 mark:



2

(f) any **two** from:
 (to make the board)

- harder
- stronger
- tougher
- more rigid

must be implied comparative statements

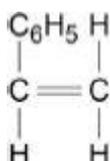
- waterproof

2

[10]

Q8.

(a)



1

(b) polymerisation

1

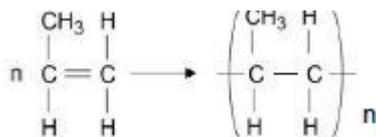
(c) monomers

1

| | |
|--|-----|
| many | 1 |
| polymers | 1 |
| <i>must be in this order</i> | |
| (d) Level 2: Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted. | 3–4 |
| Level 1: Relevant features are identified and differences noted. | 1–2 |
| Level 1: Relevant features are identified and differences noted. | 1–2 |
| No relevant content | 0 |
| Indicative content | |
| for coated paper cups – accept converse for poly(styrene) | |
| advantages | |
| <ul style="list-style-type: none"> • produced from a renewable resource • biodegradable so breaks down | |
| disadvantages | |
| <ul style="list-style-type: none"> • higher energy costs • greater use of fossil fuels and consequent pollution • not recyclable so uses landfill | |
| | [9] |

Q9.

| | |
|---|---|
| (a) water | |
| <i>allow H₂O</i> | 1 |
| <i>allow hydrogen chloride or HCl</i> | 1 |
| (b) single C–C bond and nothing added to the trailing bonds | 1 |
| 3 × H and CH ₃ correct | |
| <i>must be four single bonds</i> | 1 |
| n at bottom right | 1 |
| <i>must be fully correct to score all 3 marks</i> | |
| <i>an answer of</i> | |



scores **3** marks

(c) any **two** from:

- poly(propene) comes from a non-renewable source
allow poly(propene) will run out
- poly(propene) requires a lot of energy to make
- poly(propene) is not biodegradable
- a wool carpet needs replacing more often
must refer to the carpet, not just the fibre
- wool requires the use of large areas of land (which could be used to grow food crops)
ignore references to cost
ignore pollution
ignore landfill
allow converse arguments

2

(d) any **four** from:

advantages of polyester

- better flame resistance (so burns less easily)
allow good flame resistance so protects the firefighter
- higher melting point (so melts less easily)
allow high melting point so uniform is not damaged
- absorbs water so less likely to ignite

disadvantages of polyester:

- high density so uniform is heavy
- absorbs water so firefighter gets wet
- absorbs water so uniform becomes heavy
- justified conclusion

4

allow converse arguments throughout.

max 3 marks if only advantages or only disadvantages of one type of fibre

[10]

Q10.

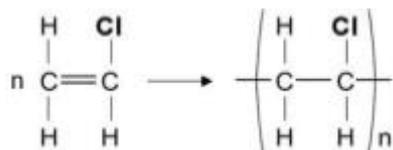
(a) chloroethene 1

(b) double bond in monomer 1

in polymer one C–C bond **and** two open ended bonds 1

'n' in front of monomer 1

an answer of:



scores **3** marks

(c) addition 1

(d) –OH 1

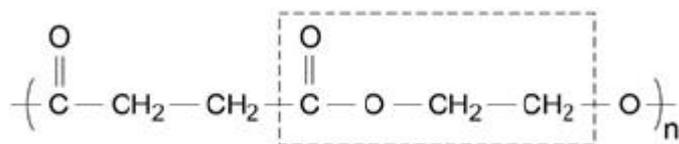
allow alcohol 1

(e) –COOH 1

(f) C=O bond 1

2 x C–O bonds 1

an answer of:



scores **2** marks

(g) water 1

(h) glucose 1

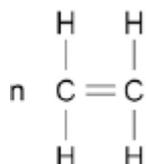
amino acids 1

(i) any **two** from:
 • two polymer chains
 • double helix

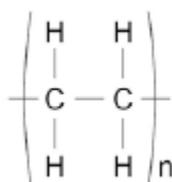
- four different monomers / nucleotides

2

[14]

Q11.(a) (*ethene*)

1

(*polyethene*)

1

(b) any **four** from:

- poly(ethene) produced by addition polymerisation whereas polyester by condensation polymerisation
- poly(ethene) produced from one monomer whereas polyester produced from two different monomers
- poly(ethene) produced from ethene / alkene whereas polyester from a (di)carboxylic acid and a diol / alcohol
- poly(ethene) is the only product formed whereas polyester water also produced
- poly(ethene) repeating unit is a hydrocarbon whereas polyester has an ester linkage

4

[6]